

Structure-Preserving Super Resolution With Gradient Guidance

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Abstract

Structures matter in single image super resolution (SISR). Recent studies benefiting from generative adversarial network (GAN) have promoted the development of SISR by recovering photo-realistic images. However, there are always undesired structural distortions in the recovered images. In this paper, we propose a structure-preserving super resolution method to alleviate the above issue while maintaining the merits of GAN-based methods to generate perceptual-pleasant details. Specifically, we exploit gradient maps of images to guide the recovery in two aspects. On the one hand, we restore high-resolution gradient maps by a gradient branch to provide additional structure priors for the SR process. On the other hand, we propose a gradient loss which imposes a second-order restriction on the super-resolved images. Along with the previous image-space loss functions, the gradient-space objectives help generative networks concentrate more on geometric structures. Moreover, our method is model-agnostic, which can be potentially used for off-the-shelf SR networks. Experimental results show that we achieve the best PI and LPIPS performance and meanwhile comparable PSNR and SSIM compared with state-of-the-art perceptual-driven SR methods. Visual results demonstrate our superiority in restoring structures while generating natural SR images.